

Reconocimiento de Patrones

Version 2022-2

Crossing Line Profiles

[Capítulo 2]

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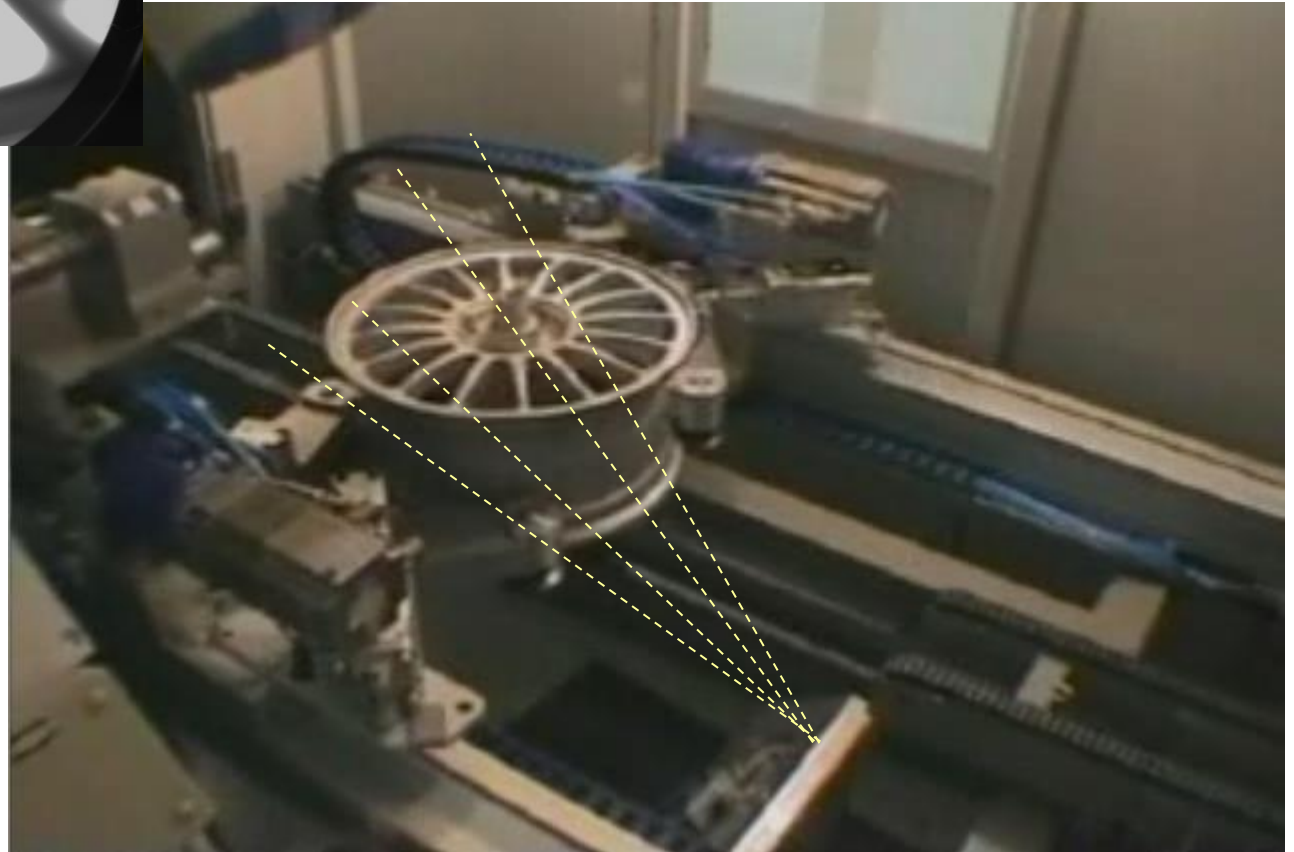
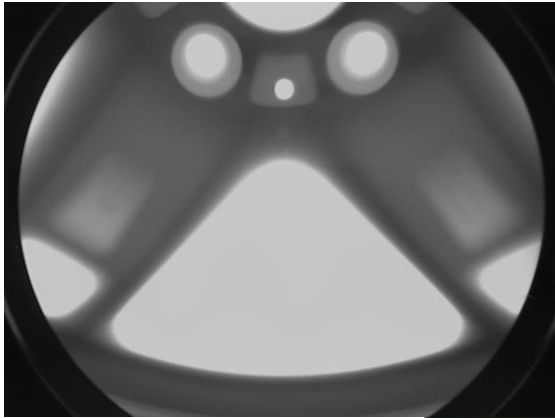
Universidad Popular del Cesar



X-ray testing: Castings



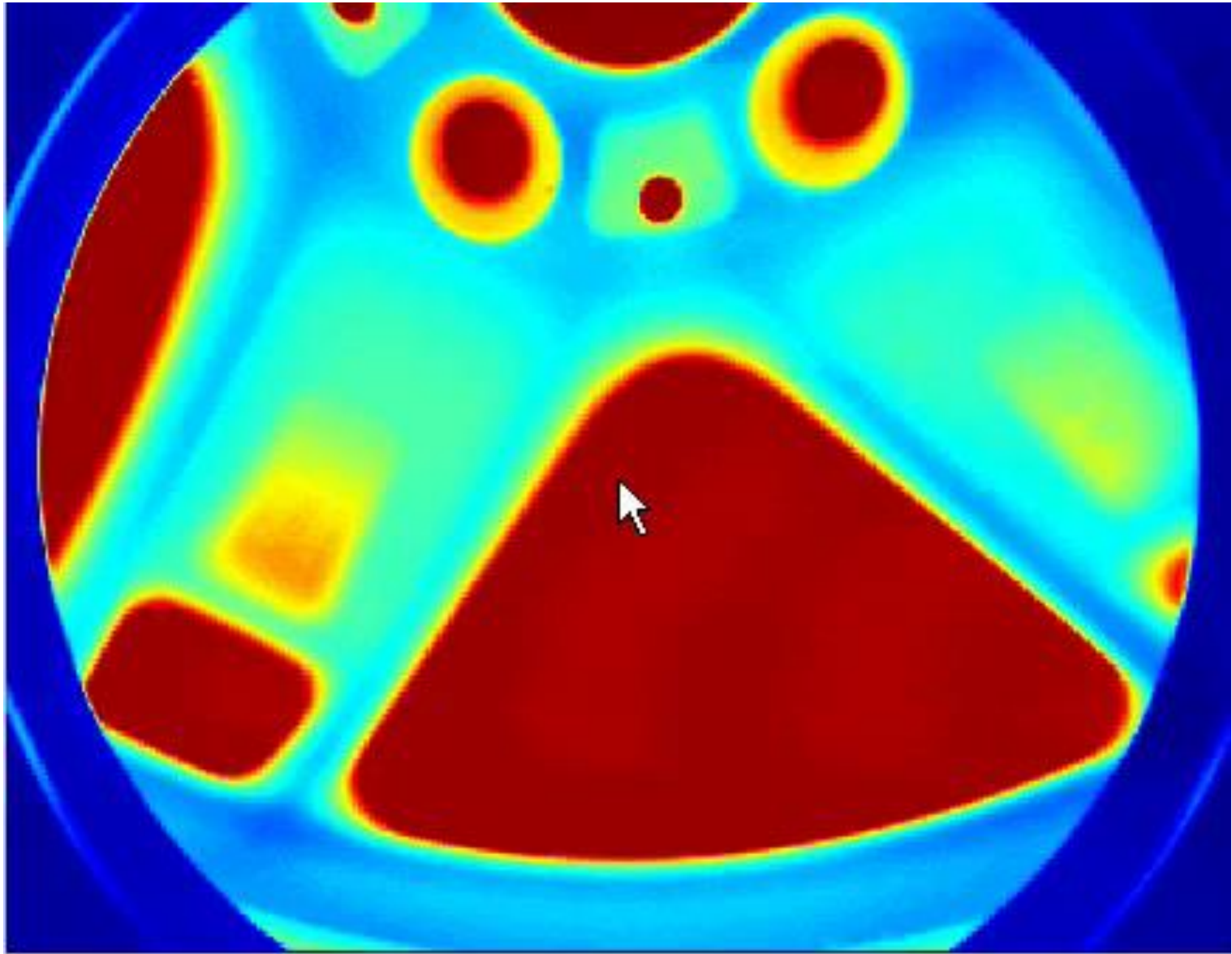
X-ray testing: Castings



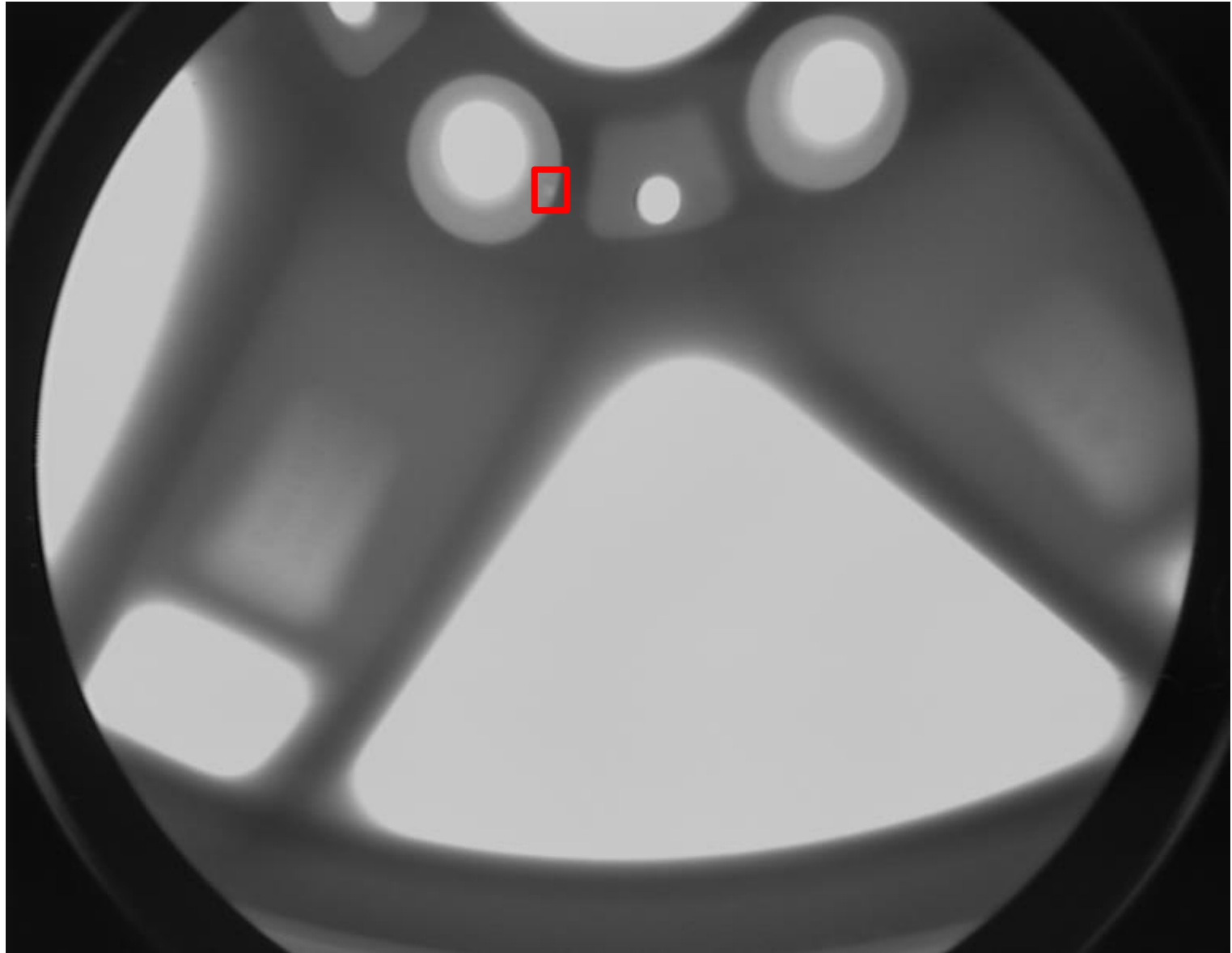
X-ray testing: Castings

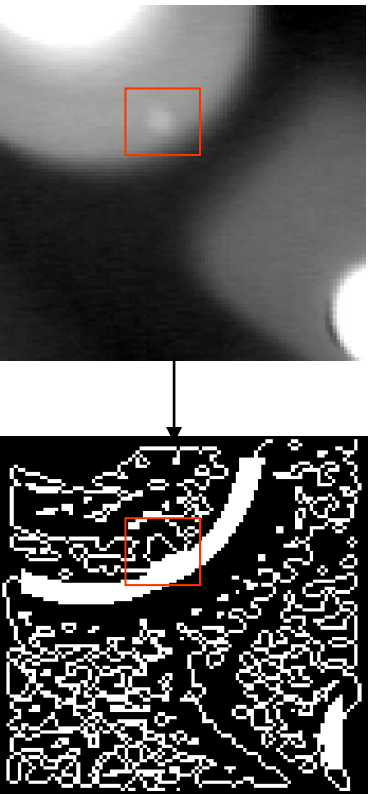


X-ray testing: Castings

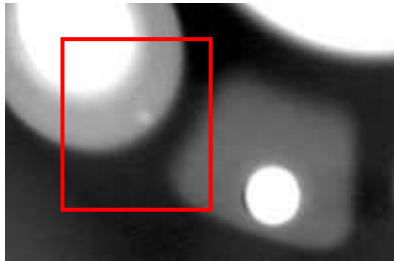


X-ray testing: Castings





[Segmentation of potential flaws]



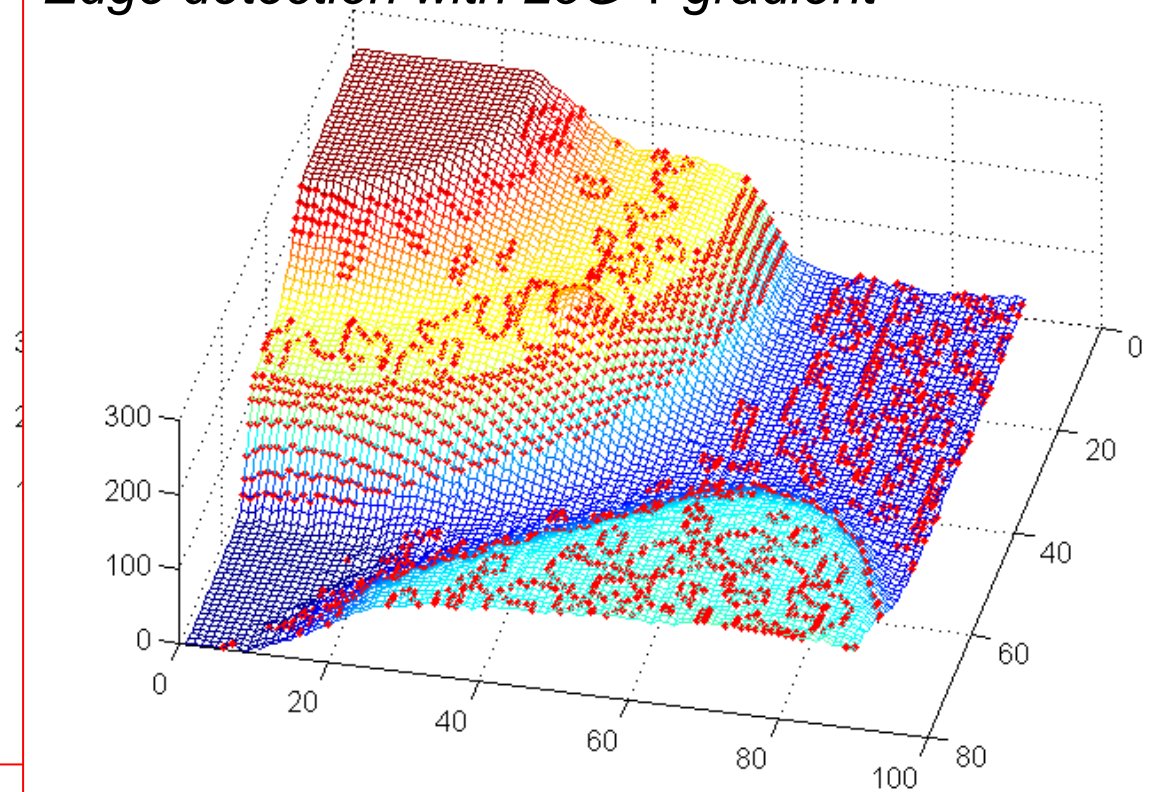
X-ray image in 3D



Edge detection with LoG

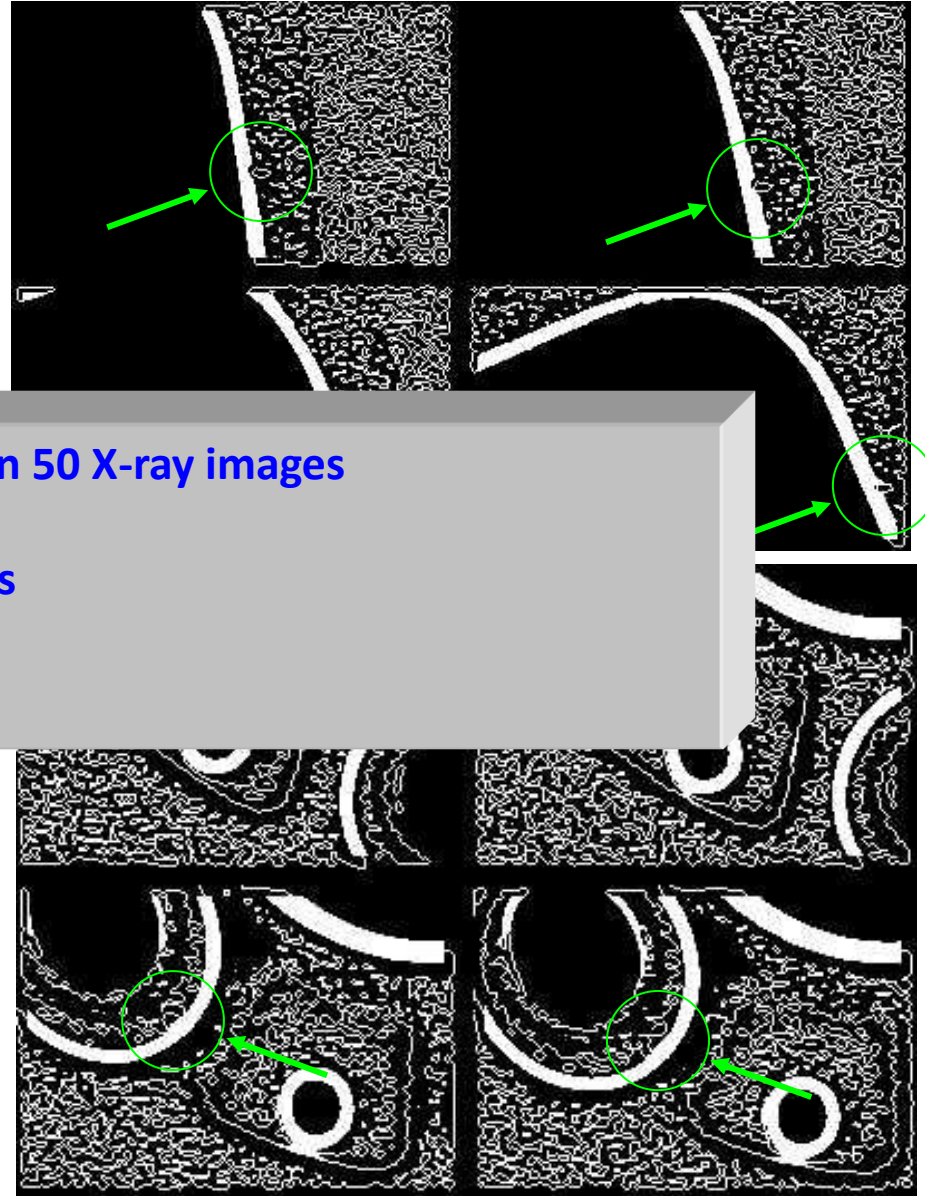
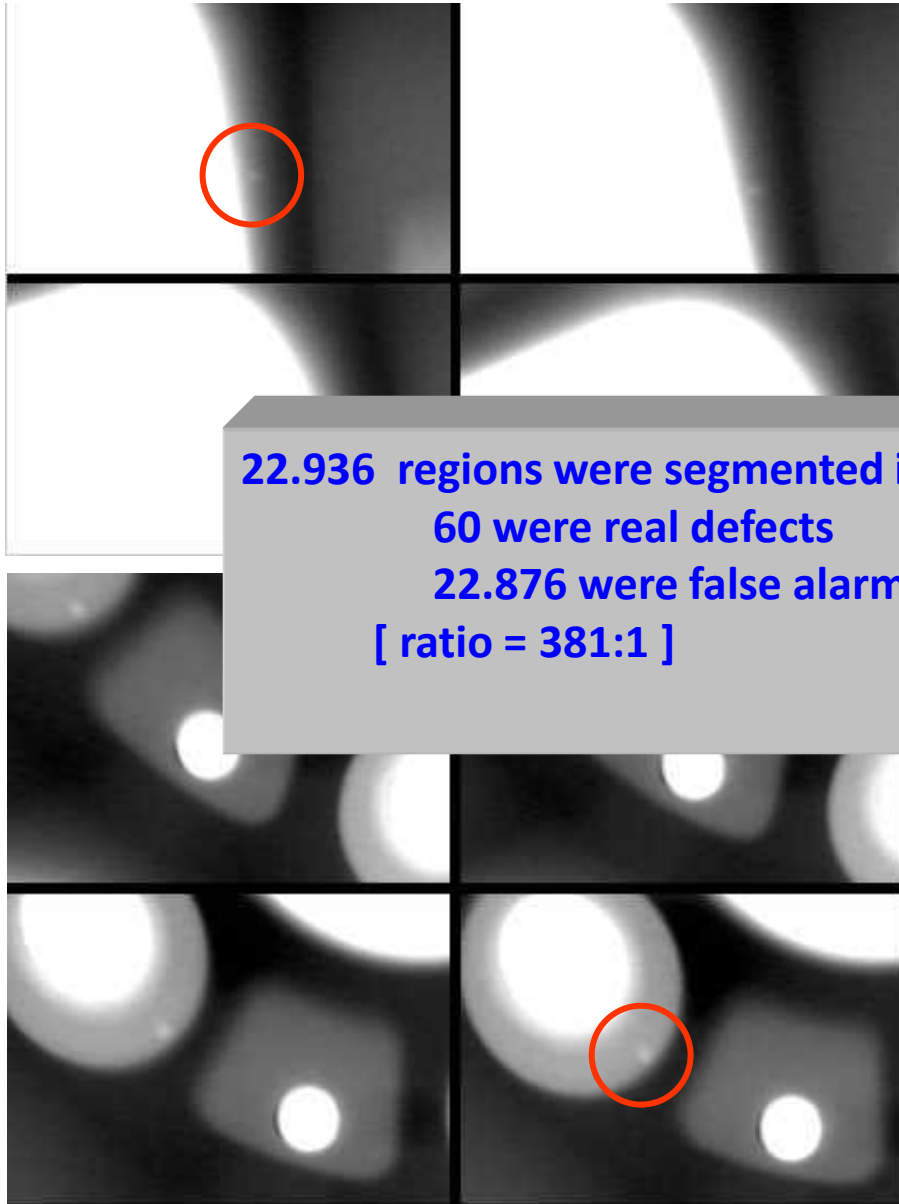


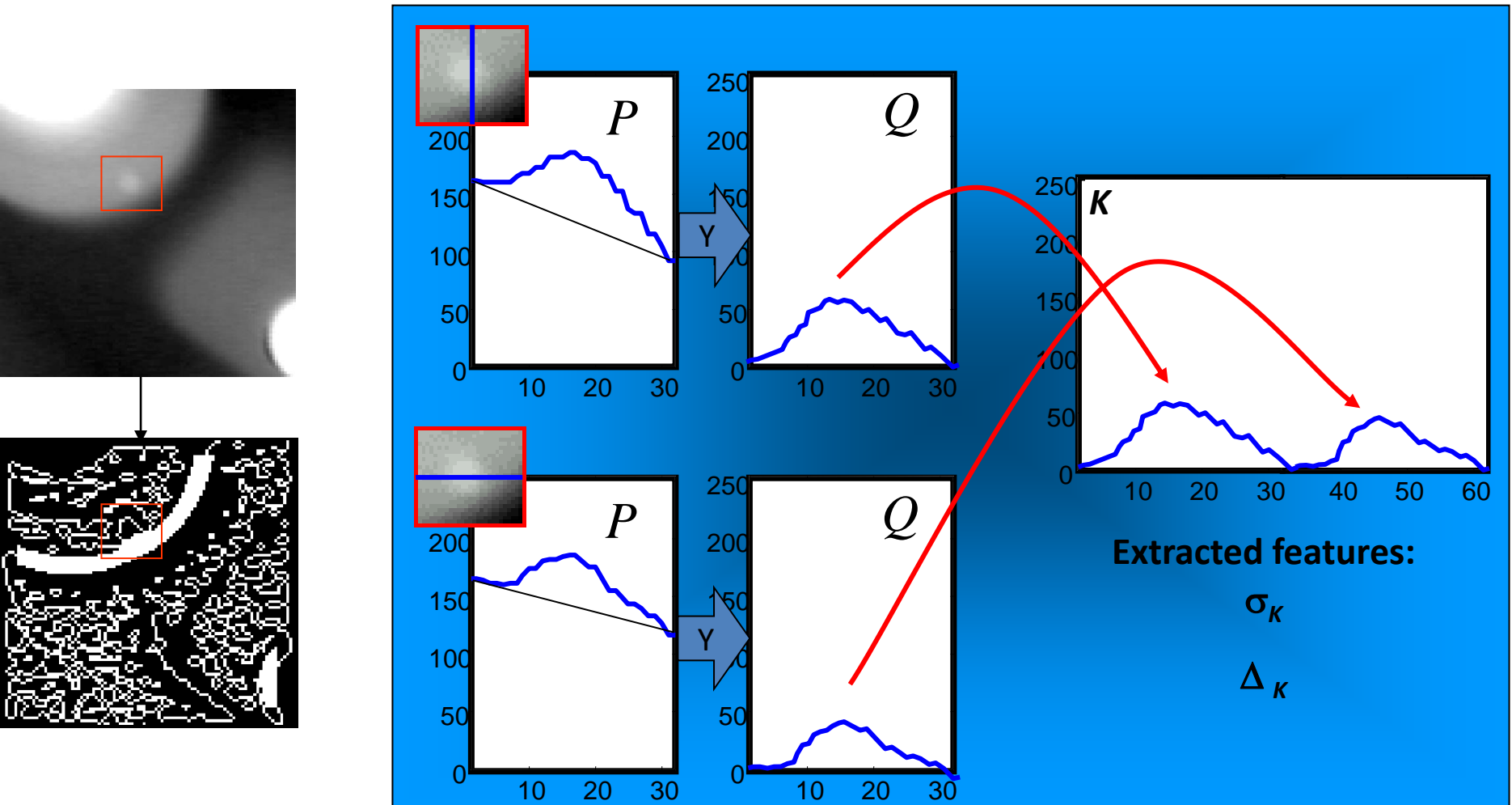
Edge detection with LoG + gradient

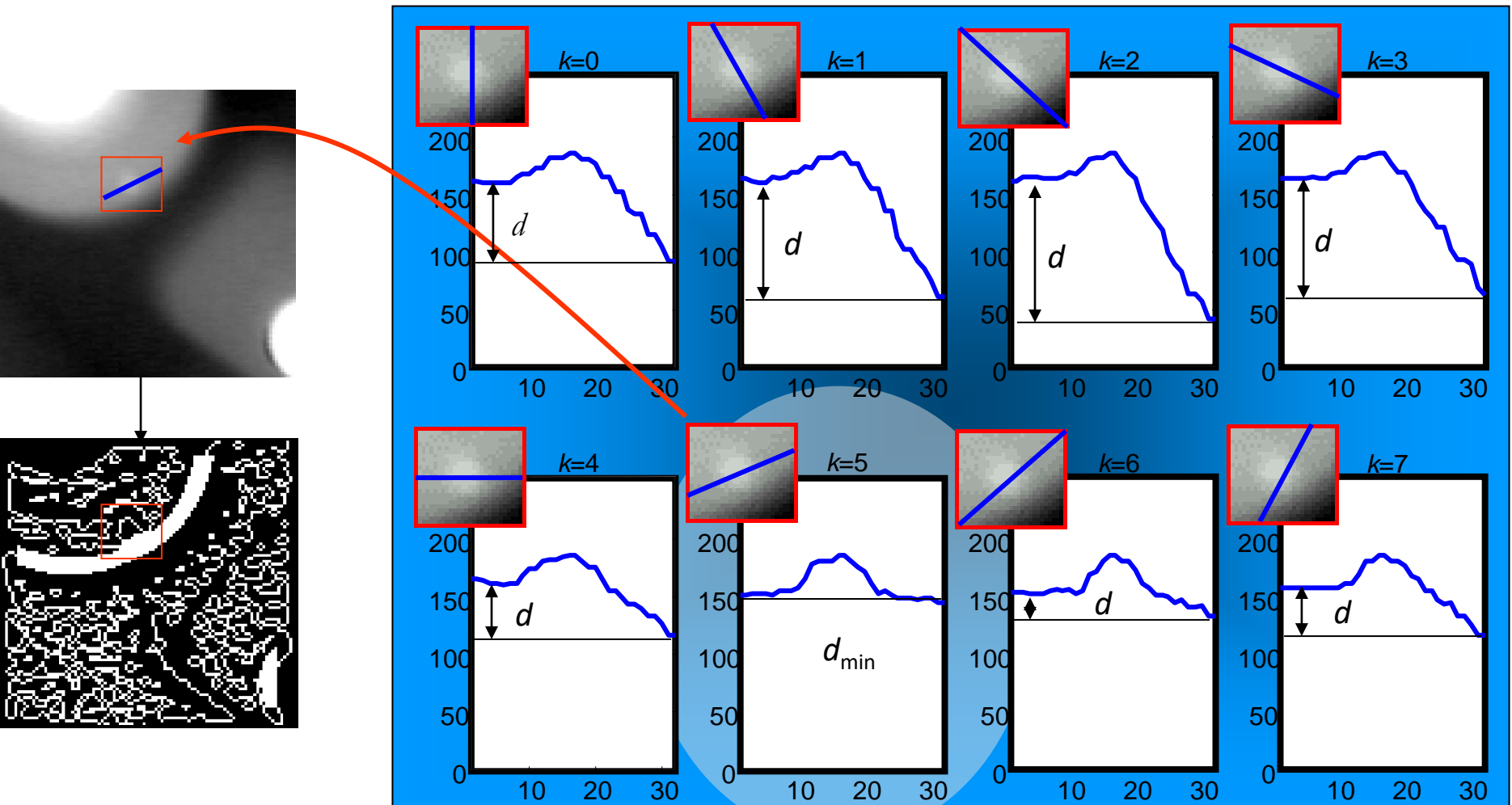


[Segmentation of potential flaws]

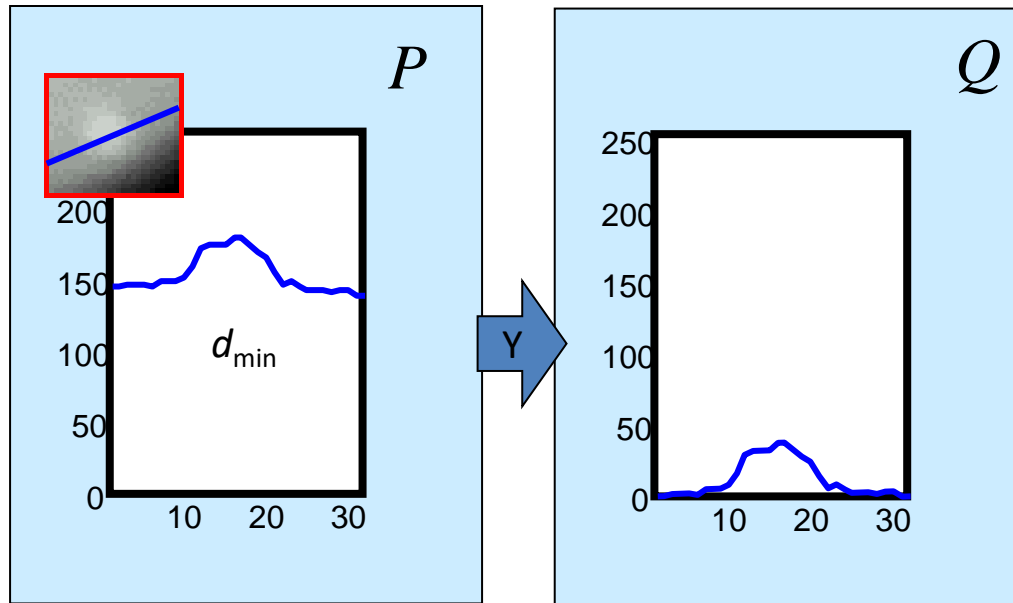
22.936 regions were segmented in 50 X-ray images
60 were real defects
22.876 were false alarms
[ratio = 381:1]







Selected Crossing Line Profile



Extracted features:

$$\overline{Q}$$

$$\sigma_Q$$

$$\Delta_Q$$

$$F = \text{DFT}(Q)$$

[4. Performance analysis]

Ideal:

$$FN = 0$$

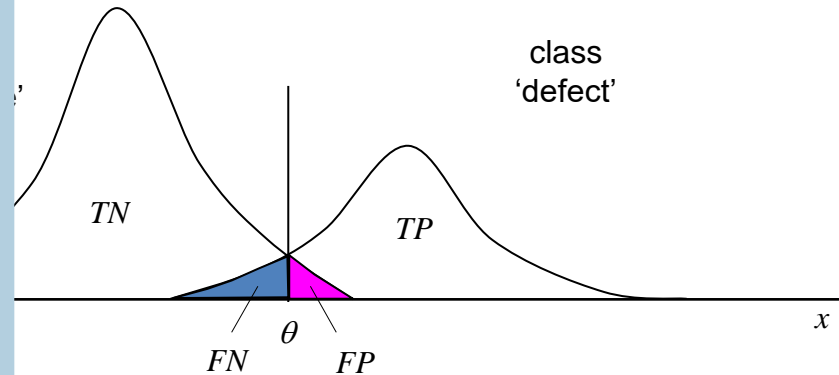
$$FP = 0$$

$$Sn = 100\%$$

$$1-Sp = 0\%$$

$$Az = 1$$

Class distribution



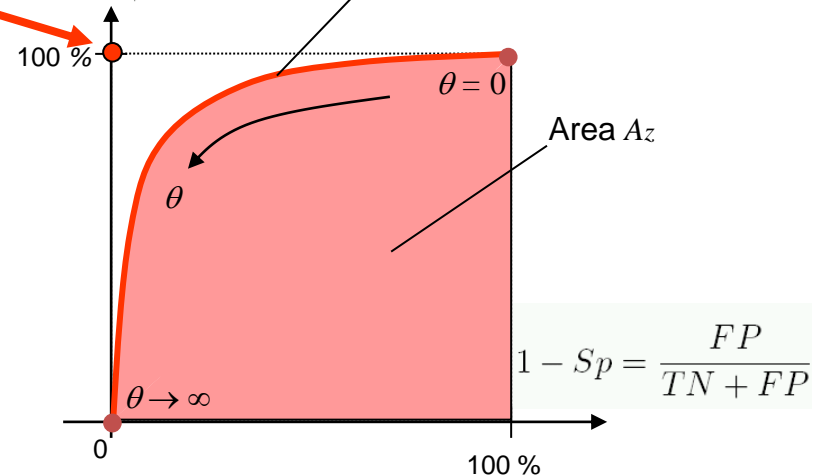
Confusion matrix

<div>the region is classified as →</div> <div>the region is ↓</div>	'regular structure'	'defect'
Regular structure	<i>TN</i>	<i>FP</i>
defect	<i>FN</i>	<i>TP</i>

(b)

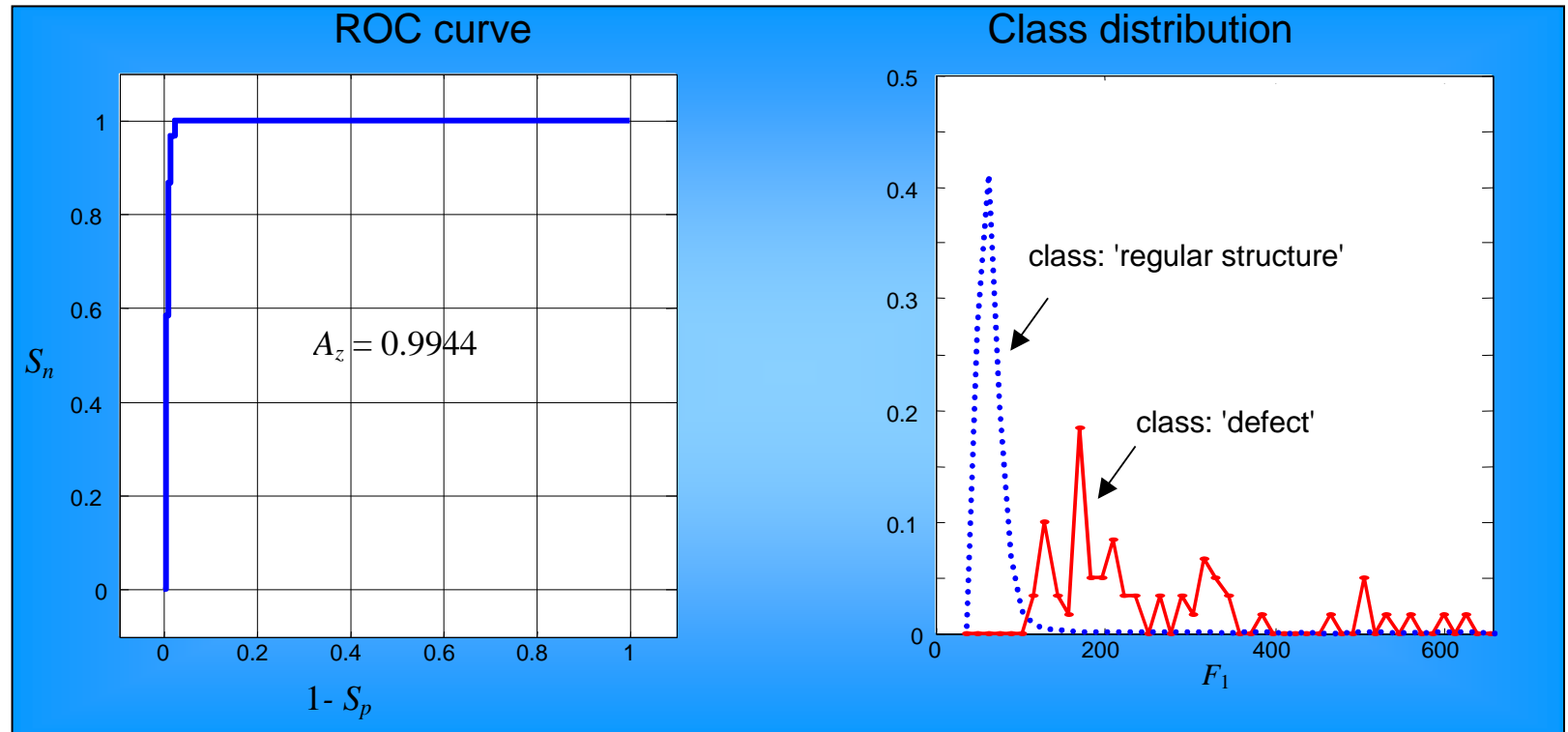
$$Sn = \frac{TP}{TP + FN}$$

ROC curve



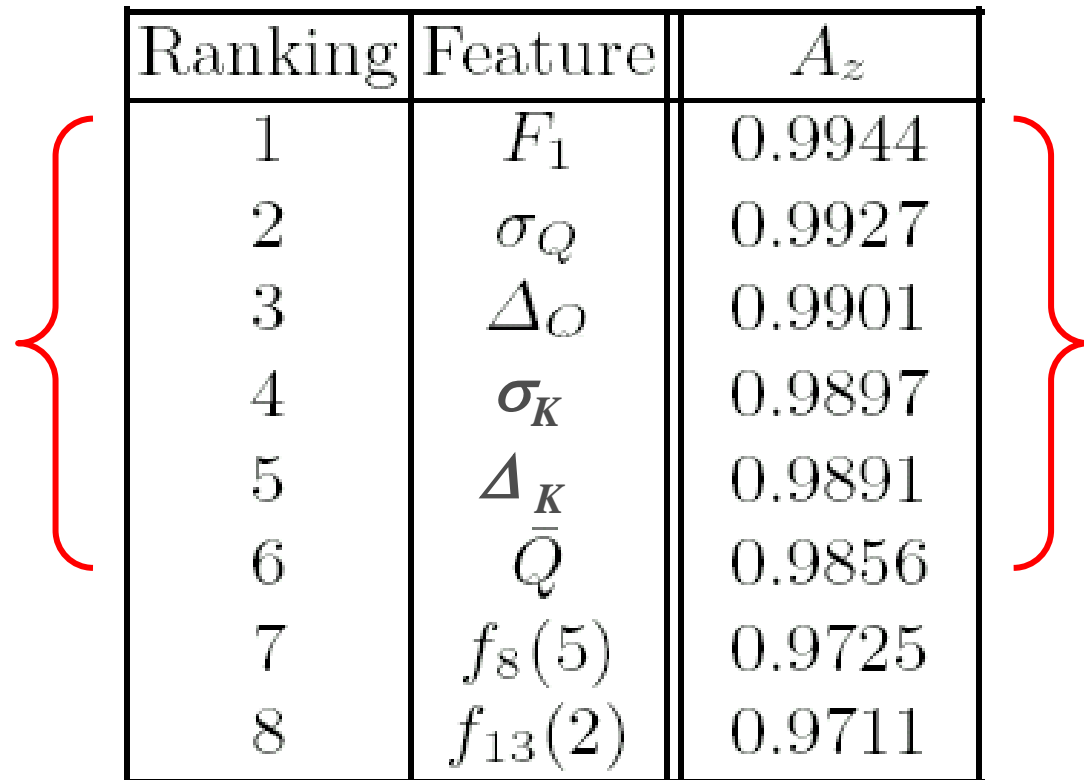
(c)

[4. Performance analysis]



ROC and class distribution for CLP feature for F_1

[4. Performance analysis]



Ranking	Feature	A_z
1	F_1	0.9944
2	σ_Q	0.9927
3	Δ_O	0.9901
4	σ_K	0.9897
5	Δ_K	0.9891
6	\bar{Q}	0.9856
7	$f_8(5)$	0.9725
8	$f_{13}(2)$	0.9711

Top six are based on CLP

[4. Performance analysis]

at $S_n = 95\%$

CLP

Ranking	Feature	A_z	$FP/image$	
1	F_1	0.9944	6.4	proposed
2	σ_Q	0.9927	8.7	
3	Δ_O	0.9901	10.8	
4	σ_K	0.9897	12.5	early work
5	Δ_K	0.9891	16.5	
6	\bar{Q}	0.9856	19.4	
7	$f_8(5)$	0.9725	34.6	texture features
8	$f_{13}(2)$	0.9711	44.1	

Threshold classifier

